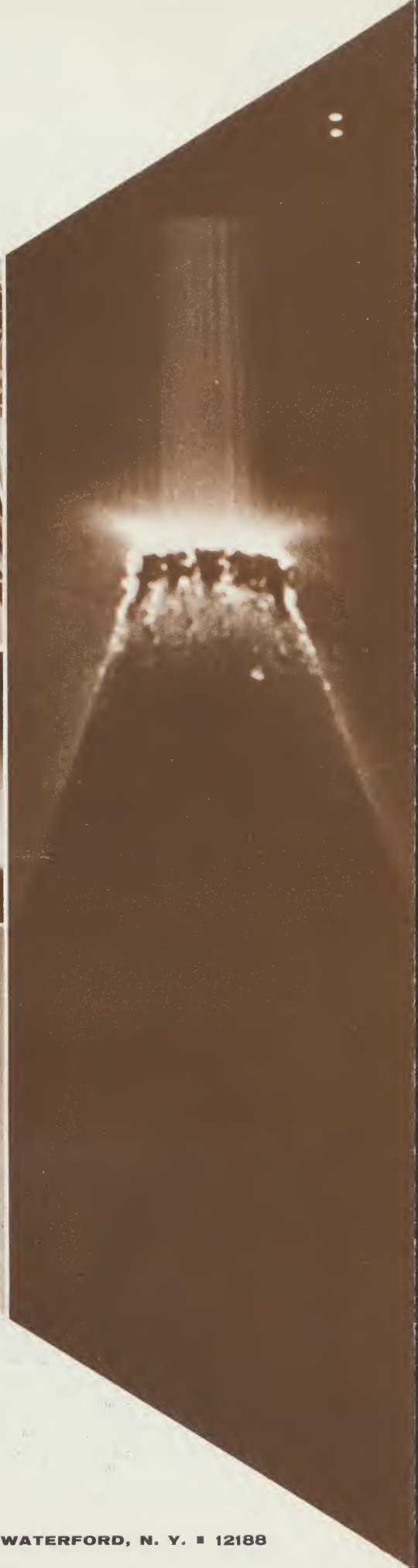
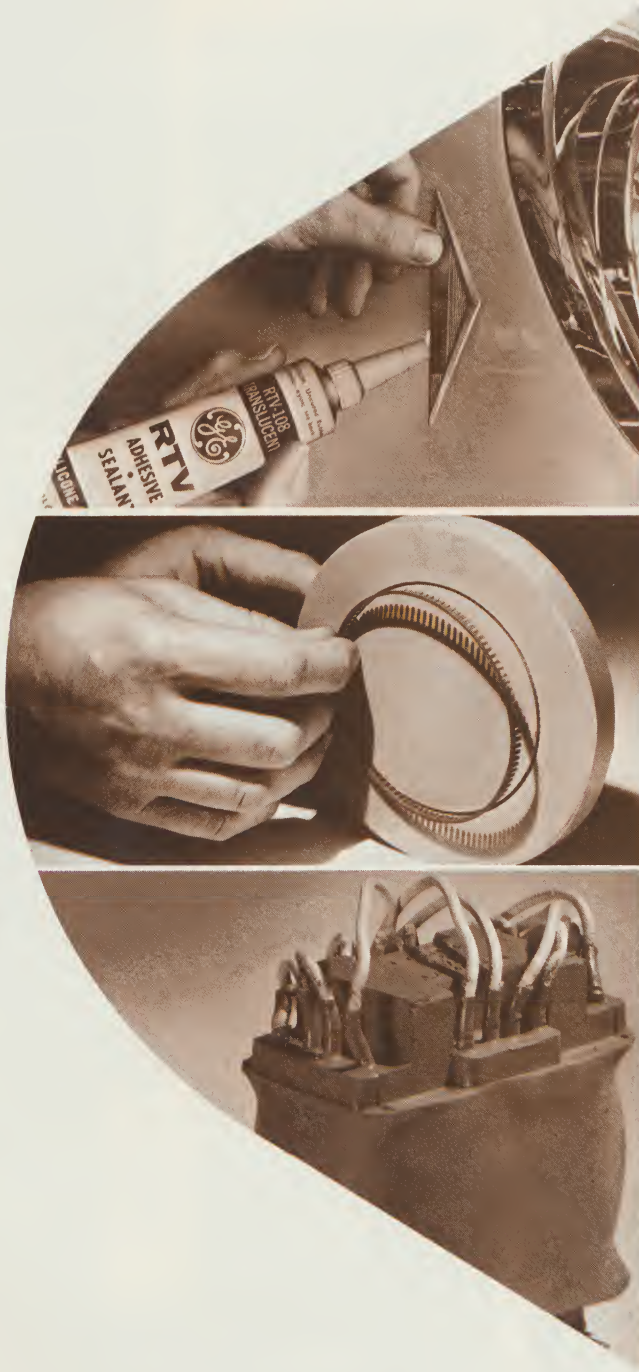




RTV

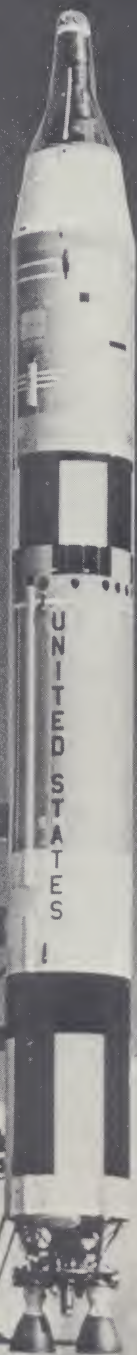
**SILICONE
RUBBER**





RTV
SILICONE
RUBBER

*a product
of space
technology*



INTRODUCTION

General Electric RTV (room temperature vulcanizing) silicone rubber compounds are liquids or pastes that cure to strong, durable, resilient silicone rubber. A complete family of RTV adhesive/sealants, available in ready-to-use, one-package form, starts to cure as soon as contact is made with the air.

However, most RTV compounds require the addition of a catalyst to initiate this cure. Cure times of these two-package RTV's can be varied from 10 minutes to 48 hours depending on the type and quantity of catalyst used. A wide range of viscosities and properties is offered to meet a variety of application requirements.

APPLICATIONS

■ High Temperature Sealing and Bonding

No other sealant can match RTV for extreme temperature performance, durability, flexibility and ease of application. Wherever they are used, these tough, flexible sealants bond to materials with a strength exceeding that of the rubber itself.

■ Electrical Potting and Encapsulating

RTV's wide usage as electrical insulation is based on its superior electrical properties coupled with its resistance to ozone and temperature extremes. It is used for potting electronic components and assemblies, for impregnating and encapsulating aircraft transformers, for encapsulating random-wound electric motors and dozens of other uses.

■ Flexible Mold Fabrication

RTV is finding increasing use as a flexible mold material because it offers the most precise reproduction of surface detail possible. Because it can replace expensive metal or hand-machined molds, it is the basis for substantial savings in such applications. Moreover, no release agent is required for RTV molds used in casting epoxy and polyester.

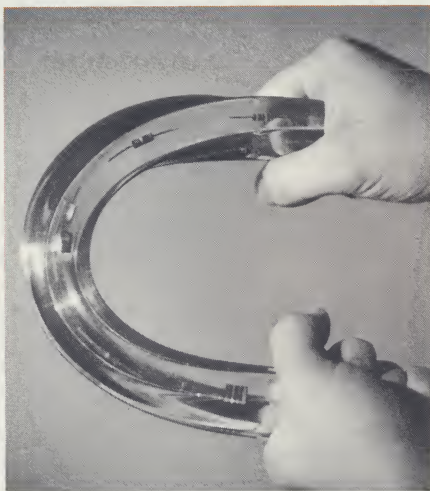
■ Aerospace Applications

RTV methyl-phenyl compounds have been formulated to meet extreme temperature requirements in many aerospace applications. They maintain flexibility at -150°F and below, yet provide long-term resistance to extreme high temperatures. These RTV's are used for electrical and mechanical insulation, and heat shield fabrication.

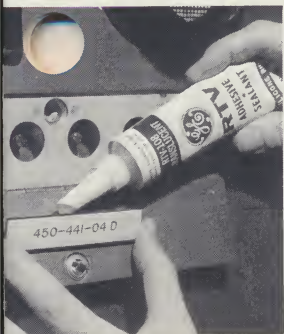
**FOR MORE
INFORMATION...**

on General Electric
Silicone Products,
just complete the
attached, self-ad-
dressed reply card.
See Page 15.

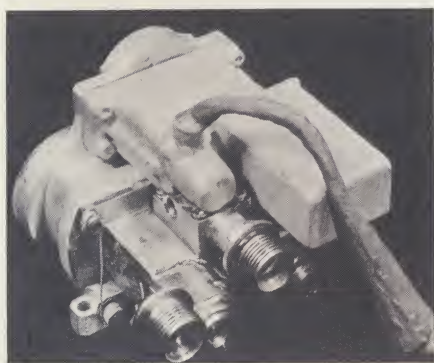
Encapsulating & Tooling ■ Aerospace Applications



RTV speeds potting rates, cures to a clear, resilient compound in 15 minutes at 150 C. It protects assemblies against thermal shock, vibration, moisture, ozone, corona, dust and chemicals.



RTV eliminates need for screws and drilling when used to affix name plates and decorative emblems on any surface.



RTV silicone rubber coating protects mechanical assemblies, like this three-position actuator, against moisture and chemicals. RTV is used on almost all U.S. missiles and space vehicles for sealing, electronic potting and encapsulating, as well as thermal insulation.



RTV provides instant, see-through insulation as well as vibration resistance and environmental protection. Applied directly from the tube, it needs no pre-mixing.



RTV combines low viscosity with high strength for filling small and complicated configurations. Excellent physical strength makes it a superior mold material for prototypes and short-run production.



RTV penetrates deep into transformer coils. As an encapsulating material, it provides excellent dielectric strength with practically no shrinkage. Cure time at room temperatures can be varied from minutes to hours.

UNIQUE PROPERTIES OF G-E RTV SILICONE RUBBER MEAN:

- **BETTER PRODUCT PERFORMANCE**
- **LOWER COST**
- **SIMPLER PRODUCTION**
- **RESISTANCE TO TEMPERATURE EXTREMES.** Retains elastomeric properties over -190°F to 600°F temperature range. As a thermal barrier or ablative coating, useful up to 9000°F .
- **GOOD PHYSICAL AND ELECTRICAL PROPERTIES.** Physical toughness and insulating ability are retained over a wide range of operating temperatures.
- **RESISTS OZONE, WEATHERING AND AGING.** RTV silicone rubber stands up for long periods of time under conditions that break down ordinary elastomers.
- **CHEMICAL RESISTANCE.** RTV resists attack from many common oils, solvents and chemicals.
- **GOOD BONDING ABILITY.** Bonds to properly primed surfaces are stronger than the rubber itself.
- **EASY RELEASE.** RTV silicone rubber has the inherent ability of silicones to release from sticking — ideal for molds or release coatings.
- **AVAILABLE IN WIDE RANGE OF VISCOSITIES.** From 12 to 12,000 poises (1,200 to 1,200,000 centipoises).
- **CONTROLLABLE CURE TIMES.** Cures at room temperature. Cure time can be varied from 10 minutes to 24 hours by proper curing agent selection.
- **MINIMUM SHRINKAGE.** Shrinkage as low as 0.2%. RTV compounds are 100% solids, contain no solvents.
- **THICK SECTION CURE.** RTV can easily be cured in thick sections.
- **RESILIENCE, ELASTICITY.** RTV silicone rubber is a true elastomer, not a flexible plastic. It will absorb shock and vibration, retains elastomeric properties at extreme temperatures.
- **APPLICATION VERSATILITY.** RTV compounds, available in viscosities from a pourable liquid to a thick paste, can be applied to objects of virtually any size and shape. Easy mixing and curing of RTV makes it an ideal "do-it-yourself" material for many applications.

selector guide

FOR G-E RTV SILICONE RUBBER

READY-TO-USE RTV ADHESIVES/SEALANTS (Require No Curing Agent)									METHYL-PHENYL RTV		
	-102	-103	-106	-108	-109	-112	-116	-118	-511	-560	-577
MAJOR USES											
Sealing	X	X	X	X	X	X	X	X	X	X	
Potting, Encapsulating						Encapsulating Only			X	X	
Flexible Mold Material											
Aerospace (Extreme Temperature)	X		X				X		X	X	X
TYPICAL UNCURED PROPERTIES											
Color	White	Black	Red	Trans.	Alum.	White	Red	Trans.	White	Red	White
Consistency	Soft, Spreadable Thixotropic Paste					Liquid	Liquid	Liquid	Easily Pourable	Pourable	Spreadable Thixotropic Paste
Viscosity, Poises	—	—	—	—	—	300	400	350	200	400	6000
Shelf Life (Months)	12	12	12	12	12	12	12	12	6	4	4
TYPICAL CURED PROPERTIES											
Specific Gravity	1.07	1.07	1.07	1.07	1.07	1.05	1.09	1.06	1.18	1.42	1.35
Hardness, Shore A Durometer	30	30	33	30	30	30	26	27	45	60	50
Tensile Strength, psi	350	350	350	350	350	300	445	520	350	800	480
Elongation, %	400	400	400	400	400	350	350	350	180	160	180
Tear Resistance, die B, lb/in	45	45	50	45	45	25	51	33	25	45	25
Brittle Point, degrees F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -150 F	Below -150 F	Below -150 F
Linear Shrinkage, %	1.0	1.0	<0.5	1.0	1.0	1.0	0.3	0.3	.2-6	.2-6	.2-6
TYPICAL THERMAL PROPERTIES											
Thermal Conductivity, Btu-ft/hr ft ² °F @ 200 F	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.15	0.18	0.18
Coefficient of Thermal Expansion, in/in °F (0-350 F)	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	<15x10 ⁻⁵	12x10 ⁻⁵	11.4x10 ⁻⁵	11.4x10 ⁻⁵
TYPICAL ELECTRICAL PROPERTIES											
Dielectric Strength, volts/mil 0.075" thick	500	500	500	500	500	500	500	500	550	550	485
Dielectric Constant @ 60 cps	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7	4.1	4.4	4.1
Dissipation Factor @ 60 cps	.0026	.0026	.0026	.0026	.0026	.0004	.0004	.0004	.005	.006	.006
Volume Resistivity, Ohm-cm	3x10 ¹⁵	3x10 ¹⁵	3x10 ¹⁵	3x10 ¹⁵	3x10 ¹⁵	2x10 ¹⁵	2x10 ¹⁵	2x10 ¹⁵	1x10 ¹⁵	1x10 ¹⁵	1x10 ¹⁵

HEAT RESISTANCE

Where retention of elastomeric properties is essential:

Short Time — Up to 600 F (red compounds)
 Short Time — Up to 500 F (white, black and transparent compounds)
 Continuous — Up to 500 F (red compounds)
 Continuous — Up to 400 F (white, black and transparent compounds)

■ The following information is intended as a guide only and has been designed to help select those RTV compounds most desirable for your particular application. All properties are typical and should not be used in preparing specifications. For assistance and recommendations in the preparation of specifications, contact General Electric Silicone Products Department, Waterford, N. Y.

2-PACKAGE RTV COMPOUNDS (Require Curing Agent)

COMPOUNDS	DIMETHYL RTV COMPOUNDS																	
	-580	-602	-615	-616	-630	-632	-634	-635	-11	-20	-21	-30	-40	-41	-60	-77	-88	-90
						X	X	X				X			X	X	X	X
	X	X	X				X		X	X	X	X	X	X	X			
					X	X		X	X		X	X		X	X			
X		X	X									X			X		X	X
Red	Clear	Clear	Black	Blue	Bl-grn	Green	Ivory	White	Pink	Pink	Red	White	White	Red	White	Red	Red	Red
Spreadable Thixotropic Paste	Easily Pourable			Pourable	Pourable	Easily Pourable	Easily Pourable	Easily Pourable	Pourable	Pourable	Pourable	Pourable	Pourable	Pourable	Pourable	Spreadable Thixotropic Paste	Stiff Paste	
8000	12	30	40	1800	480	80	80	120	250	250	250	400	400	500	6000	6000	12,000	
3	6	6	6	6	6	6	6	6	3	6	4	3	6	4	4	3	6	
1.49	0.99	1.02	1.22	1.28	1.24	1.18	1.18	1.18	1.35	1.31	1.45	1.35	1.31	1.47	1.33	1.48	1.50	
65	15	35	45	70	55	35	35	45	50	50	60	55	50	60	50	65	60	
800	—	925	925	850	700	400	400	350	450	550	750	550	500	800	500	750	750	
110	—	150	125	300	180	220	220	180	140	180	130	120	200	130	220	110	150	
40	—	25	25	90	50	20	20	15	25	30	40	25	30	40	25	40	75	
Below -150 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	Below -90 F	
.2-6	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	.2-6	.2-6	.2-6	.2-6	.2-6	.2-6	.2-6	.2-6	.2-6	
0.18	0.10	0.11	0.16	0.18	0.18	0.18	0.18	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	
11.4×10^{-5}	16.2×10^{-5}	15.3×10^{-5}	15×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-4}	11.4×10^{-4}	14.1×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	11.4×10^{-5}	
470	500	500	500	500	500	500	500	500	500	500	475	500	500	500	475	450	500	
4.1	3.0	3.0	3.0	3.2	3.1	3.1	3.1	3.6	3.6	3.4	4.0	4.2	3.8	3.7	4.0	4.0	4.0	
.006	.001	.001	.001	.019	.012	.023	.023	.019	.011	.01	.025	.02	.02	.020	.018	.023	.020	
1×10^{15}	1×10^{14}	1×10^{15}	1×10^{15}	6×10^{14}	1×10^{15}	4×10^{14}	4×10^{14}	6×10^{14}	5×10^{13}	8.8×10^{14}	2.9×10^{15}	1×10^{14}	1.5×10^{14}	1.3×10^{14}	1×10^{15}	1×10^{14}	1.3×10^{14}	

Elastomeric properties not essential:
 Integrity of material and electrical insulating ability
 retained for extended periods at 600 F and above
 Thermal Insulation:
 Short time — up to 9000 F



RTV SILICONE RUBBER ADHESIVE / SEALANTS

Available in One Package for Simple . . .

PRODUCTION LINE OR MAINTENANCE USE

Because of its easy application, fast cure, and excellent bonding ability, RTV is an ideal Adhesive/Sealant for an unlimited number of industrial applications, ranging from production work to fast, effective maintenance and on-the-spot repairs. One-package RTV's have Underwriters' Laboratories recognition.

These ready-to-use compounds cure at room temperature without addition of a curing agent and form strong bonds to most materials. After the cure is complete, the resulting product is nontoxic.

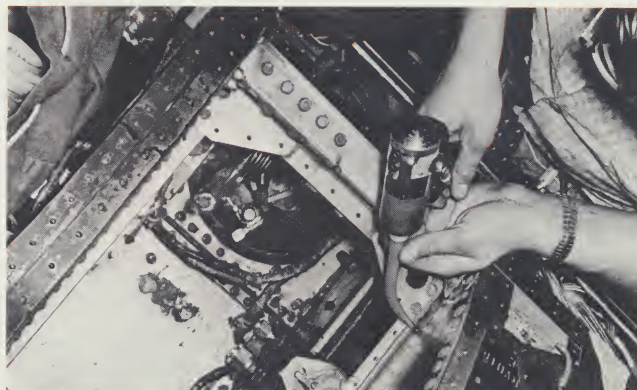
No other sealants can match their extreme temperature performance, durability, flexibility and ease of application.

COLORS AND USES

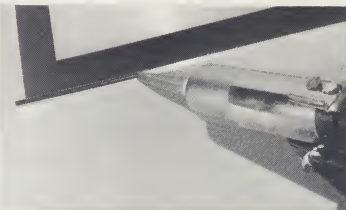
General Electric furnishes a complete family of one-package RTV Adhesive/Sealants in a range of colors and in both thixotropic (paste-like) and pourable forms. Each of these compounds offers distinct engineering and application advantages that help you select the right RTV for your particular application.

	PRODUCT	COLOR	TYPICAL APPLICATION
General Purpose Use (Thixotropic)	RTV-102	White	Affixing name plates
(Thixotropic)	RTV-103	Black	Rubber repair
(Thixotropic)	RTV-108	Translucent	See through insulation
(Thixotropic)	RTV-109	Aluminum	Metal Bonding
Extreme High Temperature (Thixotropic) (Pourable)	RTV-106 RTV-116	Red Red	Critical "high-temp" use
General Purpose Industrial Use (Pourable)	RTV-112 RTV-118	White Translucent	Brushing or spraying on a production line basis

Packaged in collapsible aluminum squeeze tubes, plastic cartridges and in five gallon pails, G-E Adhesive/Sealants are easily applied by several techniques ranging from simple dispensing to automatic production line equipment.



Above: X-15 rocket plane has critical pressurized areas sealed with G-E RTV silicone rubber.

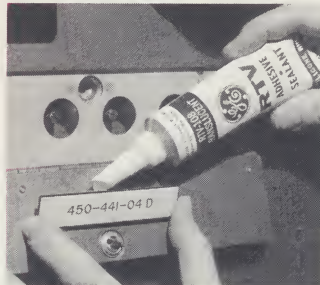


Right: RTV-106 can be used for gasket repair or gasket sealing where high temperatures would prohibit normal sealant use.

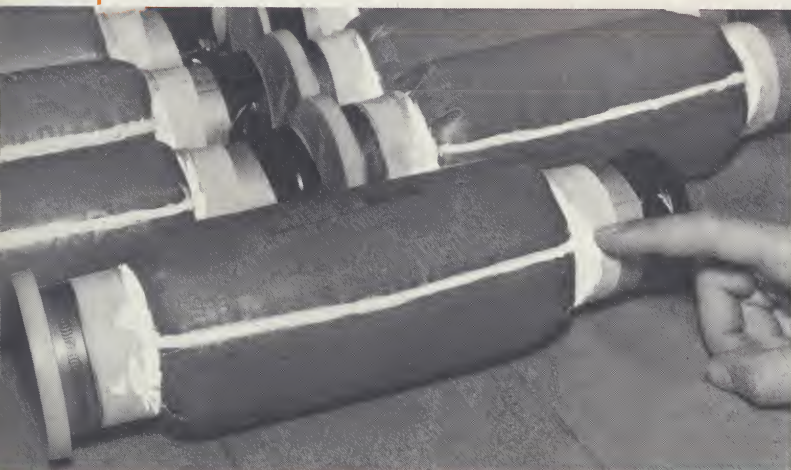
PRODUCT AND APPLICATION SUGGESTIONS

RTV Adhesive/Sealants are applied directly from the tube and will cure without any application of heat. They first form a surface skin with a complete cure progressing through the material. Under typical ambient conditions, they develop a tack-free surface in 15 to 30 minutes and cure through a 1/8 inch thickness in less than 24 hours. Lower temperatures and humidity will slow the rate of cure. Higher temperatures and humidity will accelerate the cure. (Optimum conditions are 90 F and 90% R.H.)

Ready-to-use RTV's can be applied directly from tube or cartridge. Automatic dispensing equipment is available for applying all RTV silicone sealants.



Adhere name plates with RTV. It never loses its physical and bond strength, but may be cut loose when desired.



Production sealing of hot air ducts used in Douglas DC-9 is accomplished with RTV-102 silicone rubber. It cures in place to form a solid rubber that completely seals integral parts of the ducting where temperature reaches 500 F and above. Material provides permanently flexible seal for lifetime of unit.

(Photo courtesy Douglas Aircraft Company).

... Fast ... Application

NO PRIMING NEEDED

Ready-to-use RTV's require no curing agent or primer. However, to obtain good bonds the bonding surface should be thoroughly cleaned.

When cleaning, use a suitable solvent such as toluene, xylene, or acetone to remove all dirt and grease. If possible, wipe the surface dry with a clean cloth or paper towel prior to applying the sealant.



EASILY APPLIED, thixotropic ready-to-use Adhesive/Sealant won't sag or flow, even on vertical and overhead surfaces.

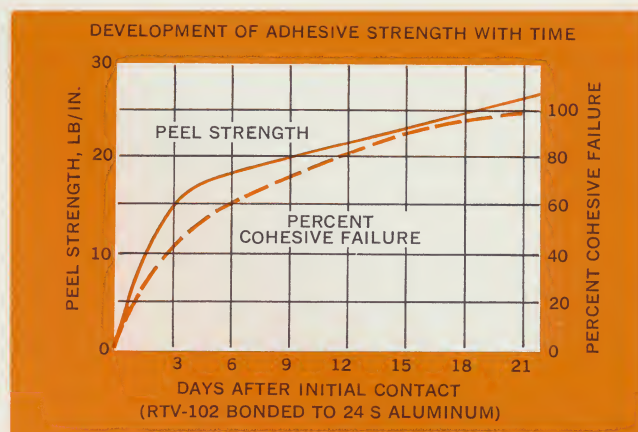
PROPERTIES

Here are properties and characteristics that make RTV silicones superior Adhesive/Sealants for industrial and maintenance applications:

Easily applied from collapsible aluminum tube ■ Applied direct from tube, no catalyst needed ■ Air cure to resilient rubber at room temperature ■ Bond firmly to most every material ■ Won't sag or flow ■ Electrical properties are virtually constant, even during cure ■ Stay flexible to -90 F ■ Withstand temperatures to 300 F (to 500 F for short periods) ■ Won't shrink or weather ■ Never harden, crack or dry out.

BONDING

RTV bonds to most materials without priming (most metals, glass, ceramics, silicone rubber and many rigid plastics). Adhesion is obtained merely by applying RTV directly to the clean substrate, completely covering the entire surface, and allowing it to air cure.



The bond will improve with time — tests have shown that after three weeks the bond strength exceeds the cohesive strength of the rubber itself.

RTV will produce fair bonds, with adhesive rather than cohesive failure, to organic rubbers or flexible plastics that do not contain fugitive plasticizing agents.

Due to the various types of bond strength required for different applications, it is suggested that a preliminary check be made to determine the bonding effects of RTV with specific materials.

Typical bond strength data available on thixotropic test samples are as follows:

Substrate*	Adhesive Characteristics, Properties			
	Shear Strength†		Peel Strength‡	
	psi	% Cohesive Failure	lb/in.	% Cohesive Failure
Unprimed Alclad Aluminum 2024-T6 per QQ-A-362	200	95-100	20	90-95
Primed — SS-4004 Alclad Aluminum 2024-T6 per QQ-A-362	200	100	20	100

*20-mesh stainless steel bonded to substrate listed

†70 hour cure at 77 F and 50% R.H.

‡7 day cure at 77 F and 50% R.H.

Similar values of adhesive strength have been obtained on such materials as anodized and alodized aluminum, copper, titanium, glass, epoxy resin, polyimides, brass, silver, carbon steel, Lexan® polycarbonate resin Textolite®, and silicone rubber (both heat cured and RTV types).



TWO-PACKAGE

RTV SILICONE
RUBBER

For Industrial Uses... Easy to Use...

- Cures at room temperature
- Color selection
- Virtually no shrinkage
- Thick-section cure

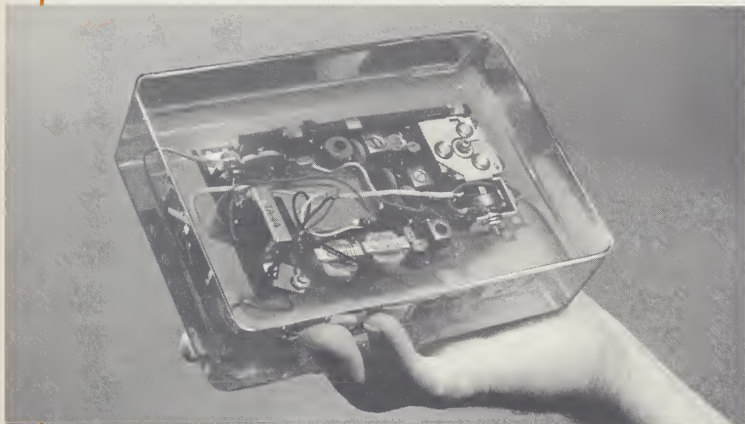
MULTIPURPOSE COMPOUNDS

General Electric RTV two-package silicone rubber compounds are liquids or pastes that cure to strong, durable, resilient silicone rubber. They cure at room temperature after the addition of a curing agent.* Cure times can be varied from 10 minutes to 24 hours depending on the type and quantity of curing agent used.

To meet widely varying application requirements, a number of products are available which offer a wide range of viscosities and properties. Typical applications for these two-package RTV systems are described below, with pertinent properties and characteristics given for compounds.

ELECTRICAL APPLICATION

RTV silicone rubber's good electrical properties, along with its resistance to ozone and temperature extremes, have led to its wide use as electrical insulation. It is also used for potting electronic components and assemblies, for im-



Clear RTV compounds are available and offer the advantages of easy identification, repair and replacement of components in potted assemblies.

pregnating and encapsulating aircraft transformers and for dozens of other applications. Used for encapsulating new and rewound motors, RTV silicone rubber affords extra protection at lower cost.

Since RTV compounds are 100% solids, they do not shrink significantly on curing. Voids and stress on encapsulated components are therefore eliminated. They are available in low viscosities for coil impregnation as well as encapsulation. Resilient silicone rubbers, they will not transmit shock and vibration as inflexible encapsulants do.

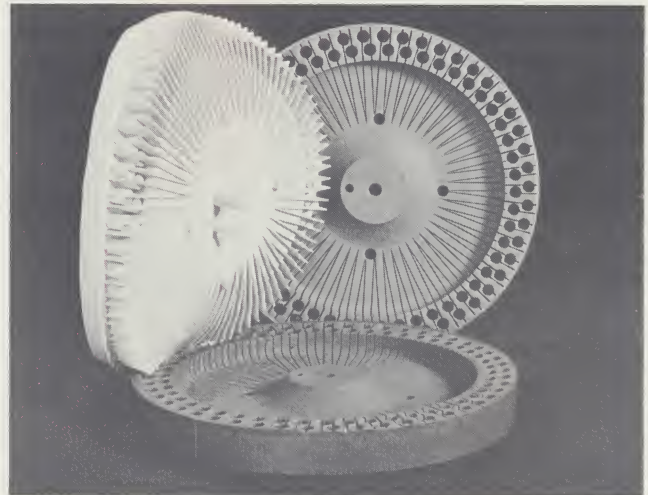
EFFECT OF THICKNESS ON DIELECTRIC STRENGTH MEASUREMENTS**

Sample Thickness, Mils	Dielectric Strength Volts/Mil
20	860
40	630
80	425
100	370

**Tests made on RTV-11 cured at room temperature. Other RTV compounds behave similarly.

IDEAL RELEASE FOR INTRICATE MOLDS

No other flexible mold material offers the precise reproduction of detail possible with RTV silicone rubber. RTV molds are being used in many applications which formerly required expensive metal molds, or to make duplicates which would require close machining to obtain the desired accuracy. Use of RTV silicone rubber makes possible very substantial savings.



RTV-630 forms thin lightweight molds, yet has properties of heat-cured rubber. Its inherent release ability means intricate castings consistently turn out clean and true to detail.

Because of its natural release ability, an RTV mold easily releases parts cast in epoxy resins without a release agent. Since RTV cures with extremely little shrinkage, mold configuration will be identical with the original. Its flexibility permits the reproduction of complicated shapes and undercuts. All of these factors add up to quality and economy previously unattainable with any mold material.

RTV molds are frequently used for low-cost plastic tooling, for reproducing models and prototype parts, for short production runs of plastic parts, and for replacement of broken parts with broken parts as masters.

*Details on selection of curing agents are given in Data Book S-3C.



Matched die mold assembly, with male punch die of RTV-630, is subjected to 5000 psi at 350 F during reinforced plastic thermoforming.

... Easy to Control

- No heat generated in curing
- Apply by spray, dip or pouring
- Wide range of viscosities
- Nontoxic

NEW HIGH STRENGTH COMPOUNDS . . . 630 SERIES

SUGGESTED APPLICATIONS IN PLASTICS PROCESSING

RTV-630 Series silicone rubber compounds are designed for use with a range of plastics — including polyvinyl chlorides, epoxies, polyesters, acrylics and styrenes — where thermoforming and casting techniques are employed. These RTV compounds can be used as production-tool or mold-making materials in the fabrication of: textured films, embossed floor products, customized marine and automotive components, and thermoformed structural parts for aerospace vehicles.

RTV-630 Series compounds can also be used in prototype mold, potting-encapsulating and general-purpose applications.



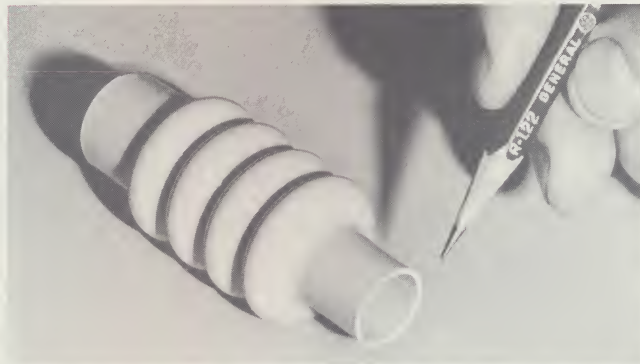
Shown here are two castings made from plastic structural parts. Darker casting, made of conventional RTV tore, broke in two pieces after a single flexing. Lighter casting — made of RTV-630 — showed no sign of tearing or material fatigue even after 2500 flexings.

RTV-630 is more than twice as tough as existing liquid silicone rubber materials.

RTV-630 is the standard bearer of this new series of two-package RTVs. RTV-632, RTV-634, and RTV-635 are complementary products, offering easier handling, reduced viscosity, color selectivity, and lower cost, with a variation in physical property profile. All these compounds are compatible and can be custom-blended to meet specific physical and viscosity requirements. Reference, Bulletin S-29.

COMPOUNDS HAVE WIDE RANGE OF USES IN MANY INDUSTRIES

Some suggested applications: as a non-stick, high temperature-resistant coating for conveyor belts in processing and handling of tacky chemicals, foods and other products; as a high-temperature sealant in manufactured products; as a protective covering for products requiring insulation from extreme heat, moisture and other severe environments; for flexible prototype or model molds; as a potting-encapsulating medium; for fabrication of silicone rubber parts.



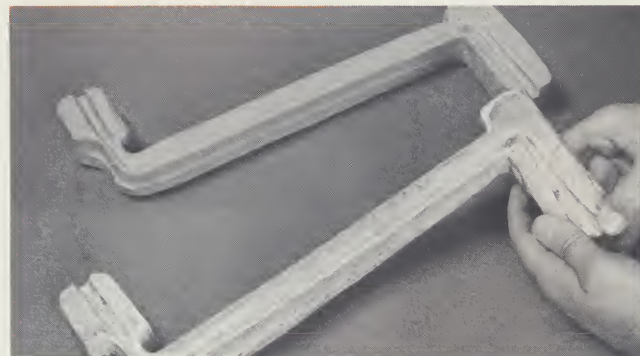
Bellows shown here is made by twice coating a glass form with RTV-630. After curing, part is stripped from form. Flexibility and toughness of RTV-630 make it well suited to short-run or prototype parts production.

STRONGER, MORE DURABLE MOLDS WITH RTV-630



With conventional RTV, molds for both intricate and simple parts had to be thick and bulky to provide mold strength and durability. Result: more RTV required to make the mold and difficulties in extracting cast parts.

Because RTV-630 is intrinsically strong, less material is needed to form the mold. Greater mold flexibility, fast, easy molded part ejection and extended mold life are major benefits of this new high strength, high endurance RTV silicone.



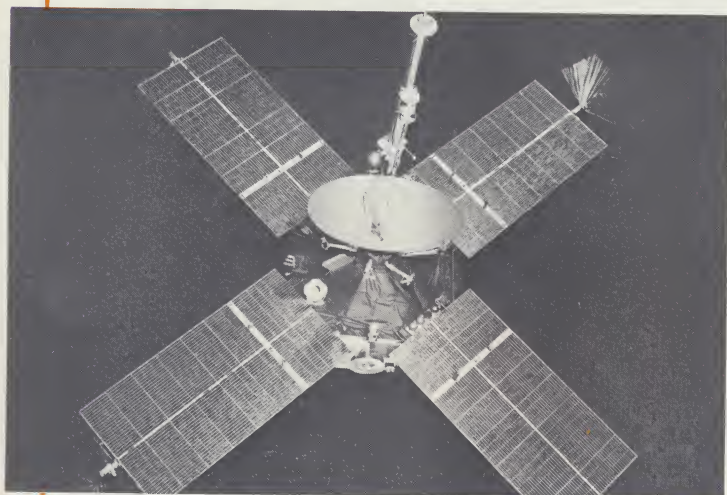
Under extreme heat and pressure, RTV-630 production molds refuse to revert, tear or pit. Compare two silicone rubber molds for forming multi-layered, glass-reinforced structural parts under 500 psi at 350 F. After 60 exposures, conventional RTV mold had a soft, spongy material, prone to pitting and tearing, with resultant defects in the finished part. Over same period, RTV-630 mold kept its integrity, with no reversion or other bad effects. Life is estimated at least six times that of conventional RTV.



EXTREME CONDITIONS ENCOUNTERED IN SPACE AND MILITARY APPLICATIONS SPUR RTV DEVELOPMENTS

- For Thermal Insulation
- Low-Temperature Flexibility
- Potting and Encapsulating
- Sealing and Bonding
- Foam and Packaging
- Ultra-High-Strength Rubber
- MIL Spec Compounds*

* For MIL Spec information write for Bulletin S-3C-1B



G-E RTV silicone rubber adhesive securely bonded 28,224 solar cells aboard Mariner on Mars flight when temperatures ranged from -392 F to +212 F.

SPECIAL PROPERTIES CONTRIBUTE TO UNIQUE MATERIALS

Methyl-phenyl RTV compounds offer the most complete balance of properties of all the extreme temperature materials offered to the aerospace engineer. Certain silicones are the only elastomers that will resist the temperature extremes of many aerospace applications.

The development of General Electric's methyl-phenyl silicone elastomers has provided silicone compounds for thermal shields capable of functioning in heating rates from three to 1200 Btu /ft.²-sec.

In addition to their use as thermal ablators, the RTV methyl-phenyl silicone rubbers offer prime potential as case insulation for solid fueled rocket motors and as insulation for launching pads.

THERMAL AND ABLATIVE PROPERTIES OF RTV-500 SERIES

Studies have shown that silicone rubber has thermal insulating properties and low-temperature characteristics that are superior to other elastomeric and plastic materials.

Effective heat of ablation characteristics of the Series 500-RTV's, for example, are eight times superior to some plastic materials. Equally important, rates of ablation are low — up to seven times smaller than other candidate materials.

Two other important application considerations: 1 — Weight losses are low... up to four times less than thermoplastics; 2 — Thermal conductivity is low... in the same order as thermoplastic materials.

This is possible because a hard, tenacious, porous surface char is formed when the material is subjected to extreme heat. In turn, the ablative silicone elastomers and residual products have low enough thermal diffusivity to minimize heat penetration into the substrates.



This 1/8 inch thick sheet of silicone rubber protects a man's hand from the 5000F flame.

New RTV compounds maintain flexibility in temperatures to -150 F and below.

GENERAL PURPOSE COMPOUNDS

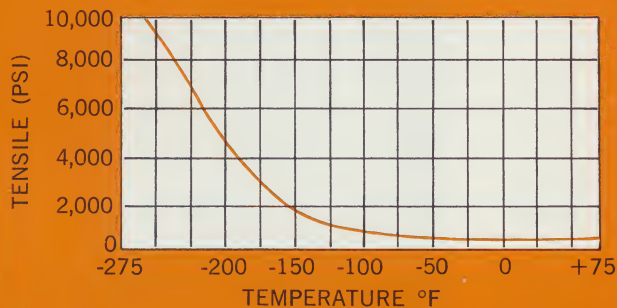
Many RTV's are especially suited to high-temperature application. Typical of the entire family of heat-resistant rubbers is RTV-60, which is the most widely used of all RTV compounds.

With a viscosity of about 500 poises, it will pour without difficulty. It provides the best physical, chemical and heat resistant properties of any pourable RTV compound. In addition, it is outstanding in terms of tensile strength, shear strength and bondability, thus making it an excellent bonding material.

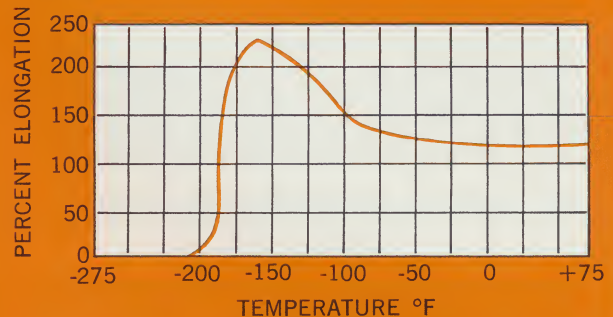
Red in color, RTV-60 is used for encapsulation of transformers, coils and motors, and for fabrication of rubber parts where its toughness provides maximum protection. Because of its very low shrinkage, greater firmness, and superior physical properties, it is widely used for release applications and flexible molds.

Defense Requirements

RTV-560 TENSILE STRENGTH vs. TEMPERATURE



RTV-560 RUBBER ELONGATION vs. TEMPERATURE



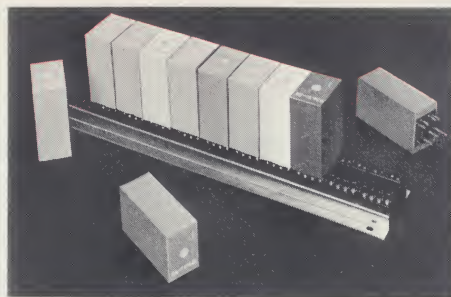
RTV SILICONE RUBBER COMPOUNDS OFFER NEW DESIGN FREEDOM

Of all the 14 basic types of elastomers available to engineers, silicone rubber shows the lowest weight loss in ultra-high vacuum conditions. It also exhibits the least change in properties over the widest temperature range.

In adhesive applications, the G-E methyl-phenyl compounds have been tested at temperatures as low as -423°F . Changes in test values are not significant from room temperature to extremely low temperatures.

The above properties make the materials ideal for sealant, adhesive, and shock-absorbing applications. Equally important in aerospace applications, silicone rubber is the only flexible insulating material which has combined heat and radiation resistance.

In design of aerospace defense equipment, RTV offers outstanding resistance to sunlight, ozone and gases. It can be made fungus resistant with proper catalyzing and meets the fungus resistance requirements of military specifications MIL-F-8261 and MIL-E-5272.



RTV provides an attractive, protective package for these components consisting of transistors and other solid state controls. Each unit is encapsulated in a different color RTV for easy identification.



GASKETS AND PARTS: Space vehicle window seals must withstand weight loss in vacuum, be non-toxic, perform uniformly in alternating hot and cold. RTV-560 retains good flexibility down to -160°F , meets non-flexible compression requirements down to -200°F .



CUSTOMIZED FOAMS: RTV-7 silicone rubber foam expands after the addition of a curing agent. RTV-7 with up to 20% concentration of the standard RTV silicone rubbers can be made in a variety of densities. This means foams can be custom-made as required for each specific application. For technical data see S-3C-2.



ELECTRICAL USES: RTV's are offered in a wide range of viscosities. Pourable compounds flow freely around parts and contours, provide excellent insulation and shock resistance.



RTV SILICONE RUBBER

Easy to Use... from small jobs to production work, application is simple

PRODUCTION LINE USE OF RTV

There is a wide selection of automatic mixing and dispensing equipment available for production line use of both one-part and two-part RTV's. For additional information write for bulletin CDS-598.

RTV's may also be applied by spraying from a solvent solution. Instructions for mixing with solvents and suggestions for spray equipment are included in bulletin TSR-1714.

For the small job RTV is one of the best easy-to-use, do-it-yourself materials with no special equipment required. Easy-to-follow directions for handling small amounts of RTV are shown on the following page.



READY-TO-USE... ONE-PACKAGE RTV ADHESIVE/SEALANTS

Applications Unlimited: Ideal for electrical, electronic and mechanical uses, these one-package compounds cure at room temperature to a tough, resilient adhesive. It's easy to repair open wiring, secure and insulate terminals and connections with this excellent dielectric material.

New mechanical applications are being found daily for this all-purpose Adhesive/Sealant — bonds to most all materials, including glass, aluminum, steel, ceramics, leather, some plastics, and numerous other surfaces.

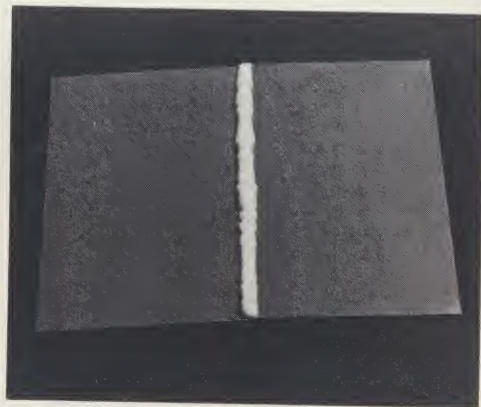
RTV will always remain flexible, will never harden, will never lose its grip.

Whatever your product or your process, you have built in assurance of the quality and properties in G-E RTV silicone rubber. These one-package compounds are recognized by Underwriters' Laboratories and ingredients are F.D.A. sanctioned.

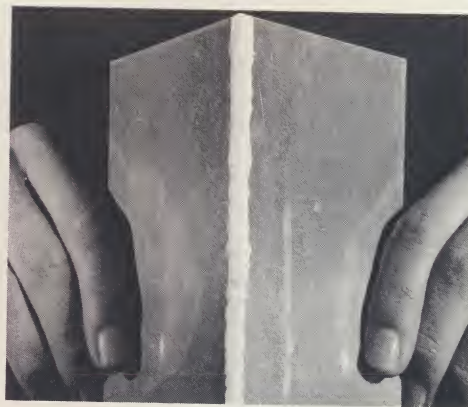
The illustrations below show how easy it is to apply RTV and demonstrate the flexibility retained by the material after bonding.



1 Apply directly from tube — no catalyst or primer needed.



2 Cures at room temperature on exposure to normal moisture in air.



3 Cures to durable, flexible silicone rubber. Forms excellent bonds.

USE THE TWO-PACKAGE RTV COMPOUNDS . . .

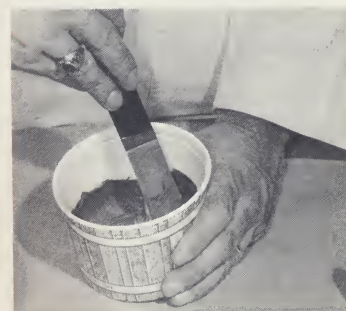
FOR GENERAL APPLICATIONS



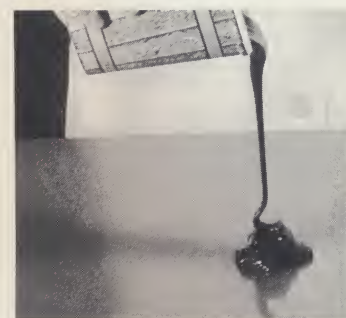
1 Measure sufficient RTV for your application.



2 Add curing agent. Quantity and type will determine cure rate.



3 Mix thoroughly. Keep air entrapment and bubbles to a minimum. In most cases deaeration is recommended after mixing.

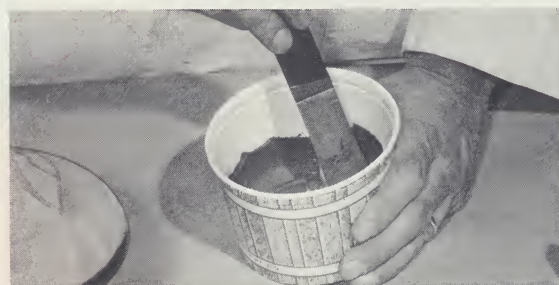


4 Apply by any convenient method — pouring, dipping, brushing.



5 Allow to cure at room temperature — forms durable, resilient rubber.

IN MOLDING PROCESSES



1 Mix RTV and curing agent. Avoid air entrapment and bubbles. Vacuum treatment or deaeration will assure complete air removal.

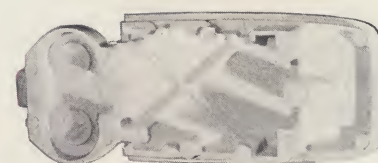
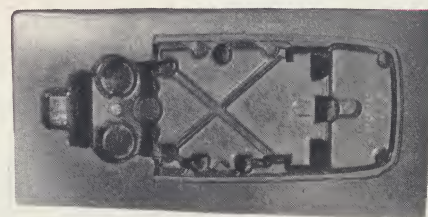


2 Paint RTV on master pattern to assure coverage and penetration into fine details.



3 Pour remainder of RTV over pattern. RTV can be retained with wooden blocks or a cardboard box.

This Mold Produces Precise Reproductions of Master Pattern



HOW TO GET PERMANENT BONDS . . .

RTV bonds to most materials

1-PACKAGE RTV's:

Adhesion is obtained merely by applying RTV directly to the clean substrate, completely "coating" the entire surface and allowing it to air cure. Thorough cleaning before application is important and solvents such as toluene, xylene, or acetone are recommended. Adhesion is best when surfaces are dry, and most materials can be bonded without a primer. However, for extremely difficult to bond metals, such as nickel or stainless steel, a primer is advisable (SS-4004, SS-4101, or SS-4044).

2-PACKAGE RTV's:

Two-package RTV's can be bonded to most metals, plastics, glass, etc., by using a suitable primer. When properly applied, a bond results that is stronger than the rubber itself.

Priming Procedure

All surfaces to be bonded should be thoroughly cleaned with a suitable solvent such as toluene, xylene, etc. Primers can be applied by brushing, dipping or spraying. A uniform primer coat of approximately 0.5 to 1 mil in thickness usually provides the strongest bond.

It is important to allow the primer to air dry for at least a half hour (an hour is better) before the RTV is applied. On porous surfaces a second coat of primer may be required, allowing at least an hour drying time between coats.

Apply the RTV compound by laying it in place on the primed surface without severe rubbing, which might disrupt the primer coating.

Bonding to cured silicone rubber surfaces (RTV or heat cured) generally does not require the use of a primer.

Primers Available

SS-4004 PRIMER: The bright, fluorescent pink color of SS-4004 makes it easy to determine whether a uniform coating has been applied. Fast-drying solvents (acetone and isopropanol) in SS-4004 speed up drying time, but these solvents are highly flammable and precautions must be taken to keep the primer away from fire or flame. The low flash point of SS-4004 prevents its being shipped by parcel post, except in sample quantities.

SS-4044 CLEAR PRIMER is a clear, colorless primer identical to SS-4004 except for the absence of the red color. The same solvents are employed and the same flammability precautions apply.



SS-4101 PRIMER is blue in color and is especially designed for spray application. It may also be applied by dipping or brushing.

Precautions in Handling Primers

Primers should only be used in areas which have sufficient ventilation. Persons should not breathe these vapors for prolonged periods.

SS-4004, SS-4044 and SS-4101 primers should be used within six months of receipt if maximum bond strength is desired. In storage, they should be kept sealed and placed in a cool, dark area.

A slight precipitation can be expected. This in no way harms the product. Do not shake the bottle prior to use, but carefully decant the clear primer from the top of the bottle as needed.

RTV Clean Up and Removal

Before curing: any solvent may be used, although hydrocarbons like trichloroethylene or aromatic hydrocarbons like xylene are somewhat more effective. A relatively good solvent consists of 70% carbon tetrachloride and 30% hexane. Solvent toxicity should be investigated, especially with carbon tetrachloride.

After curing: removing RTV which has been bonded to metal, plastic or glass surfaces is simplified by immersion in a number of suitable stripping solutions. Systems that are water soluble organic acid or alkaline solvent blends are effective. However, excessive skin contact or vapor inhalations must be avoided.

Aromatic solvents like toluene or xylene and chlorinated solvents like trichloroethylene will swell the cured rubber and soften it temporarily to facilitate mechanical removal. Hot solvent is generally faster and more effective. Bonded parts are often best cleaned with a combination of something to swell the rubber first and then acetone to soften the primer bond.

Selection of the swelling solvent or chemical treatment should be based on the substrate concerned and safety precautions necessary in the handling area.

RELEASING RTV FROM MOLDS

Where RTV materials are cured in molds, sticking may occur after repeated usage. The use of a mold release is suggested for such situations. For all RTV's, a 5% concentration of household detergent, such as Dreft, in water has proved satisfactory.

TYPICAL PROPERTIES — RTV SILICONE PRIMERS

Property	SS-4004	SS-4044	SS-4101*	SS-4120	SS-4155
Color	Fluorescent Pink	Clear	Blue	Clear	Blue
Solids, % (45 min. @ 150°C)	15-18	15-18	15-18	2-6	8-12
Specific Gravity (25°/4°)	0.84-0.86	0.84-0.86	0.92-0.96	0.80-0.84	0.80-0.84
Dry Time, hrs.	<1	<1	1	1	1
Use With	General Purpose RTV's RTV-500 Series RTV-602	Same	Same	RTV-615, 616 RTV-630 etc.	RTV-615, 616 RTV-630 etc.

*SS-4101 also acts as a barrier coat and release for the RTV-630 series.

LOWERING VISCOSITY WITH RTV DILUENTS

FOR GENERAL PURPOSE AND 500 SERIES COMPOUNDS

For some applications it is desirable to lower the viscosity of the general purpose and RTV-500 series silicone rubber compounds to obtain better flow. RTV-910 and RTV-911 diluents are dimethyl silicone fluids intended to be used for this purpose. Although RTV-910 and RTV-911 diluents are effective in lowering viscosity of uncured RTV silicone rubber compounds, this is accomplished only with some slowing of curing rate and sacrifice of final cured properties of the rubber. Slower cure rate can be compensated for by use of increased concentration of curing agent. Although physical properties are adversely affected, electrical properties are not.

TYPICAL PROPERTIES — RTV DILUENTS

	RTV-910	RTV-911
Appearance	Clear, Colorless	
Viscosity, centistokes, $\pm 5\%$ (at 25°C)	50	500
Specific Gravity (25°C/25°C)	0.96	0.97
Pour Point	-60 F	
Flash Point	Above 600 F	
Volatility (% Wt. loss, 24 hrs. at 150°C)	0.5% max.	



Quantities to Use

It is suggested that, wherever possible, diluent additions be limited to 5% of the weight of the RTV compound. The maximum recommended quantity is 10% by weight. Beyond this point reliability of cure and performance are inconsistent.

Effect on Viscosity

The effectiveness of these diluents on reduction of the viscosity of RTV-11 and RTV-60 liquid silicone rubber compounds varies, depending upon the compound and diluent. It is suggested that tests be conducted to determine the ideal combination of compound and diluent for your particular application.

Effect on Cure Rate

The addition of silicone oil diluents has a tendency to slow down the room temperature cure rate of RTV compounds. As a rule of thumb, the addition of 5% diluent will

increase pot life up to about 50%, while 10% oil addition may nearly double it. Total cure time is affected to a lesser degree. To compensate for the slower cure rate, a somewhat higher concentration of curing agent may be used.

Most satisfactory cures of RTV compounds containing silicone fluid diluent are obtained at room temperature. To accelerate the cure, or to prepare cured material for service at temperatures of 300 to 600 F, heat may be applied. However, application of heat must be made slowly to prevent blowing of the cured rubber, particularly in sections over a quarter inch in thickness. It is recommended that sections up to one-half inch thick be allowed to cure for 24 to 72 hours before heating, and that the temperature then be raised in increments of 50 F for 24 hour periods, starting at 150 F, until the service temperature is reached.

Effect on Cured Physical Properties

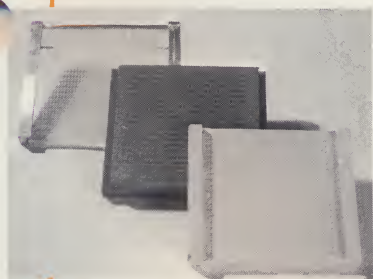
In the quantities recommended, the addition of RTV-910 and RTV-911 diluents causes an appreciable, but not severe lowering of durometer hardness and tensile strength. Ultimate elongation is affected very little.

Effect on Electrical Properties

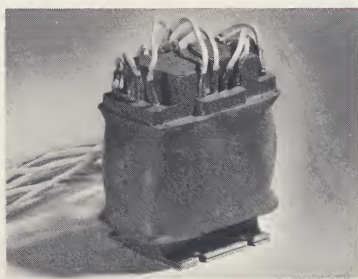
The electrical properties of these silicone fluids are excellent. They have no deleterious effect on the electrical properties of RTV silicone rubber to which they may be added.

Storage and Handling

RTV diluents should be kept in clean, covered containers, free from contamination. Storage temperature is not significant with these materials. Shelf life is indefinite.

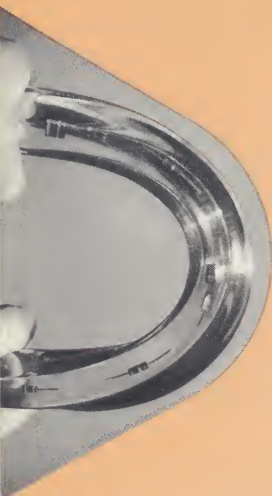


Lower viscosities are desirable when making RTV molds to reproduce very fine detail. However, the use of diluents will lower the physical properties of the cured rubber which may reduce the useful life of the mold.



For applications, such as impregnating aircraft transformers, where viscosities lower than those available are desired, RTV diluents may be used to lower the viscosity of standard RTV compounds. After the impregnation, unit can then be encapsulated with higher viscosity RTV.

Inasmuch as General Electric Company has no control over the use to which others may put the material, it does not guarantee that the same results as those described herein will be obtained. Each user of the material should make his own tests to determine the material's suitability for his own particular use. Statements concerning possible or suggested uses of the materials described herein are not to be construed as constituting a license under any General Electric patent covering such use or as recommendations for use of such materials in the infringement of any patent.



GENERAL  ELECTRIC SILICONE PRODUCTS DEPARTMENT, WATERFORD, N. Y. ■ 12188

Please send me additional information on the following type of G-E Silicone Products:

- ☐ Dielectric Fluids
- ☐ Dielectric Compounds
- ☐ Lubricating Fluids and Greases
- ☐ RTV Silicone Rubber
- ☐ RTV Adhesive/Sealants
- ☐ Silicone Rubber for Fabricated Parts
- ☐ Silicone Varnishes and Resins
- ☐ Silicone Rubber for Tapes and Sleeving
- ☐ Silicone Rubber Insulated Wire and Cable
- ☐ Other:.....

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COMPANY

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